Technologies

Intelligent Software Systems

Researchers at the U.S. Army Research Laboratory are studying how to apply intelligent software systems to the battlefield for synchronizing events, doing background processing, alerting the user of key activities, and adding autonomy to robots.

The 21st century battlefield will be full of complex information dynamics. There are new sensors, a myriad of other local and remote information sources, and more advanced information processors. There are also new battlefield functions coming on line. These rapidly emerging information technologies and requirements must interact to provide effective battlefield information systems.

"We are investigating how to use intelligent software systems, and specifically autonomous agents, to help manage the constantly changing information dynamics of the future battlefield," said Phil Emmerman, associate director for technology for the Information, Science and Technology Directorate at the U.S. Army Research Laboratory.

The view of the future battlefield shows that there will be intelligent physical agents or robots and other forms of intelligent automation called software agents. The agents will have different levels of autonomy but they're all geared toward helping address the issue of a smaller military force that has overwhelming information resources and must perform dangerous, difficult tasks.

"We want to give our reduced forces as much automation as possible so they will be able to do their job better with fewer injuries and casualties," Emmerman added.

ARL researchers have conducted a number of workshops and experiments with the high-end users and the Battle Labs and they are starting new programs associated with the research. Emmerman believes that ARL has significantly helped the Army begin to formulate the battlefield robotics requirements for the future. He said robotics systems requirement documents are now in place for the Army and the Marines.

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Turbine Engine Diagnostics

ARL played a major role in the development of a Turbine Engine Diagnostics (TED) System that helps mechanics find and fix problems with the M1 Abram's AGT 1500 turbine engine.

The system can not only diagnose system faults, it can order spare parts, provide instructions on how to perform required repairs, tests to ensure repairs correct the problem, maintain necessary maintenance records or forms and provide an on-line tutorial on AGT1500 turbine engine maintenance procedures.

more than 65 National Guard units. Currently, fielding to Active Army units is being conducted through Project Manager-Abrams.

TED enables mechanics to trade in the current hard-to-use technical manuals structure for an easy to-use computer system designed to run on any 486/586 PC platform.

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Salivary Amylase Field Assay Kit

Stress is a constant enemy of the soldier affecting his or her performance both on the battlefield and in training. A commander who can quickly determine how stress is affecting the performance of troops and can identify those soldiers who are more resilient to stress, will be in a position to make decisions that could improve performance, better perform the mission and, possibly, save lives.

A team of researchers at the Army Research Laboratory has come up with the tools to do that. Led by Linda T. Fatkin of the Human Research and Engineering Directorate at Aberdeen Proving Ground, Md., the team has spent the past decade developing a method to characterize the effects of situational stressors found in combat such as fatigue, chemical decontamination, and psychological stress on soldier performance.

Determining stress levels is done by measuring the activity of an enzyme, amylase, that is present in people's saliva, Fatkin explains. Increased activity of amylase can correlate to increased levels of stress hormones such as cortisol, she adds. To measure the amylase activity, ARL researchers, in cooperation with Dr. Robert Chatterton of the Northwestern University Medical School, developed a Salivary Amylase Field Assay Kit.

The kit uses a sponge to collect a sample of the soldier's saliva that is mixed with chemical solutions that trigger a color change. The speed of the color change with allowances for outside temperatures are correlated with a table developed through field assay procedures by Chatterton to indicate stress levels. Generally, the faster the color change, the higher the level of stress.

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Hostile Environment Simulator

Developed by the Human Research and Engineering Directorate, the Hostile Environment Simulator (HES) is used by researchers assessing physiological and cognitive stress that soldiers undergo during combat by permitting them to safely experience the sights, sounds and feel of battle.

The HES is located in a 2,500 square foot acoustic chamber. It uses a 50,000 watt sound system to produce levels up to 155 decibels distributed to 33 loudspeaker systems. Sounds are mixed with a 12-channel audio mixer, processed in surround sound and then sent through 40 amplifiers that include 12 sub-bass woofer systems.

High resolution visual simulations are computer generated onto a 15-feet by 20-feet projection screen. Computer-controlled, high-power strobe lights provide bursts of light associated with the launch and impact of artillery shells.

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Center provides real VALUE

A software integration and demonstration laboratory under development at the Adelphi site is changing the way researchers work with and within the Army Research Laboratory.

The Visualization Augmentation Laboratory (for) User Experiments (VALUE) center combines a unique blend of integration software technologies, visualization display modalities, infrastructure for collaboration among users and tools for conducting experiments. It is a tangible network of hardware and software that provides the foundation to accept and integrate a wide variety of software technologies to evaluate new concepts in battlefield information processing for the Army. Until now there has been no architecture or infrastructure at ARL permitting researchers to do that Ð not in real-time, not with the results depicted on 100-inch diagonal screens and not with external colleagues and customers available to participate in the work via video teleconference.

It isn't the large screens, but the center's architecture that provides it's foundation and pivotal capability. While the ability to link numerous processors into a network, to transport and download software technologies has existed for some time; what has eluded researchers is the ability to integrate the products and outputs of high resolution workstations such as SUN and SGI, along with MacIntosh and IBM compatible hardware. The VALUE center has the capability to link disparate research environments by permitting users to view the output of up to seventeen workstations and personal computers.

The VALUE center also provides ARL the capability to integrate and evaluate software concepts with other agencies through the use of the Army Interoperability Network (AIN). The AIN is a nationwide network of communications services, remote facilities, systems expertise and test access capabilities which support experimentation, development, test and evaluation, sustainment and training.

In addition, ARL is developing hardware and software specifications for communication and data exchange with its partners in ARL's Federated Laboratory to conduct interactive demonstrations and tests together. The objective is to allow consortium partners to transport research products into ARL's facilities for integration and review.

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Honors and Awards

Robotics Expert Honored For Service

Charles M. Shoemaker of ARL's Weapons and Materials Research Directorate, has received the Meritorious Civilian Service Award. Shoemaker is a physical scientist and an internationally known expert in robotics technology. He was cited for his significant contributions to the field of unmanned ground vehicle robotics and his outstanding contributions to the development and maturation of an emerging technology.

Due to his expertise, he was named director of the OSD Unmanned Ground Vehicle Technology Base Program by the Strategic and Tactical Systems Office of the Undersecretary of Defense for Acquisition and Technology. He has shown cased robotics technologies in a series of highly successful field exercises and demonstrations showing the development, growth and maturation of robotics technologies for autonomous, unmanned ground vehicles.

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Last modified: December 08, 1999
Form 1 Cleared: October 15, 1998